

New Hampshire Department of Environmental Services

Volunteer River Assessment Program

2010 Programmatic Report & QAQC Audit Overview

Program Summary

In 2010 VRAP supported 23 volunteer groups and 198 volunteers who monitored 239 stations on numerous rivers and watersheds throughout the state (Table 1, Figures 1 through 4). These volunteers contributed approximately 1, 130 hours of time solely collecting in-situ data (Figure 3).

2010 QA/QC Summary (Table 1)

- VRAP volunteers collected **7,453** field parameters. Of these, **96%** were valid and usable for the 2012 NH Surface Water Quality Assessments.
- VRAP volunteers collected **777** laboratory samples. Of these, **99%** were valid and usable for the 2012 NH Surface Water Quality Assessments.
- The total number of samples (field parameters and laboratory samples) collected by VRAP volunteers was **8,230**. Of these, **96%** were valid and usable for the 2012 NH Surface Water Quality Assessments.

Table 1: 2010 QAQC Data Summary Statistics

Type of Sample	Number of Samples Collected	Number of Invalid Samples	Percent (%) Invalid Samples	% Valid Samples Usable for 2012 NH Surface Water Quality Assessments
Number of Field Parameters	7,453	304	4.08%	95.9%
Number of Laboratory Parameters	777	02	0.26%	99.7%
Total Number of Samples (Field + Lab)	8,230	306	3.72%	96.3%

Figure 1:

Number of VRAP Groups 1998-2010

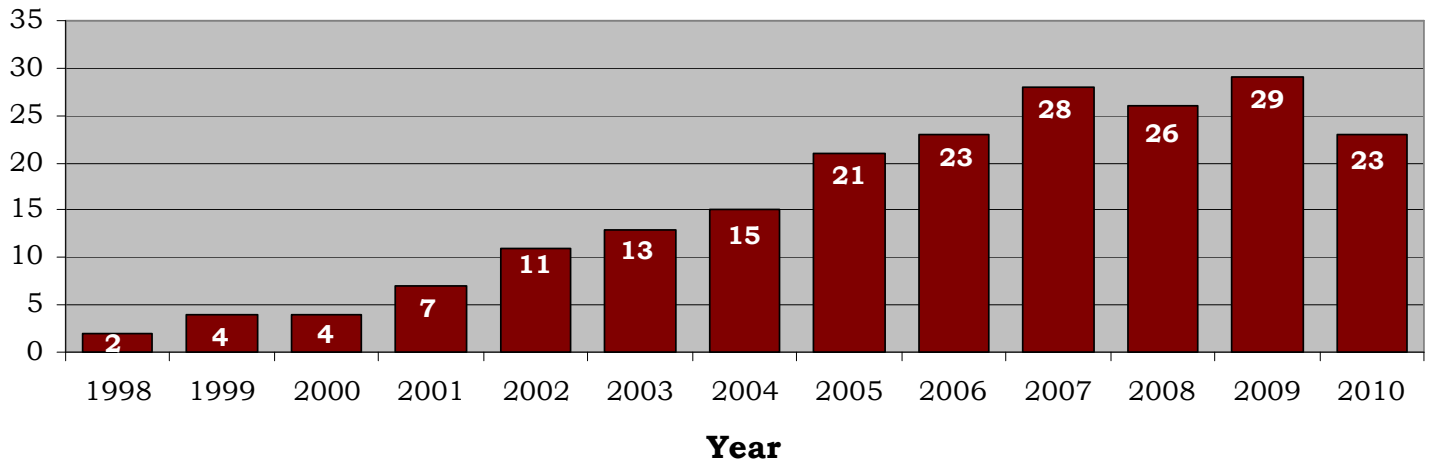


Figure 2:

Number of VRAP Volunteers 2003 - 2010

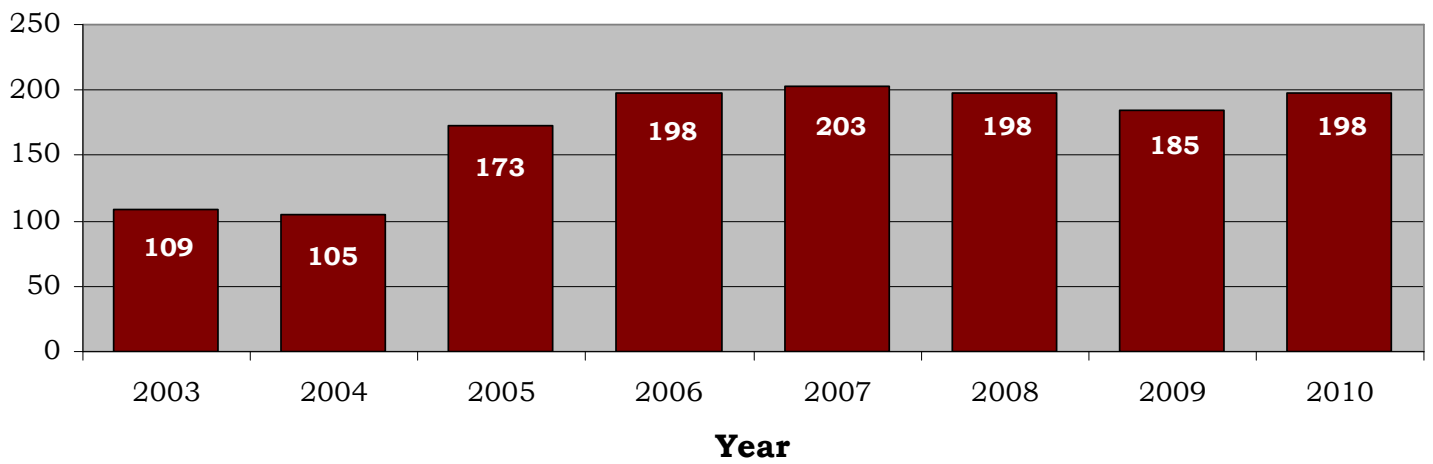


Figure 3:

Number of VRAP Volunteer Hours 2003 - 2010

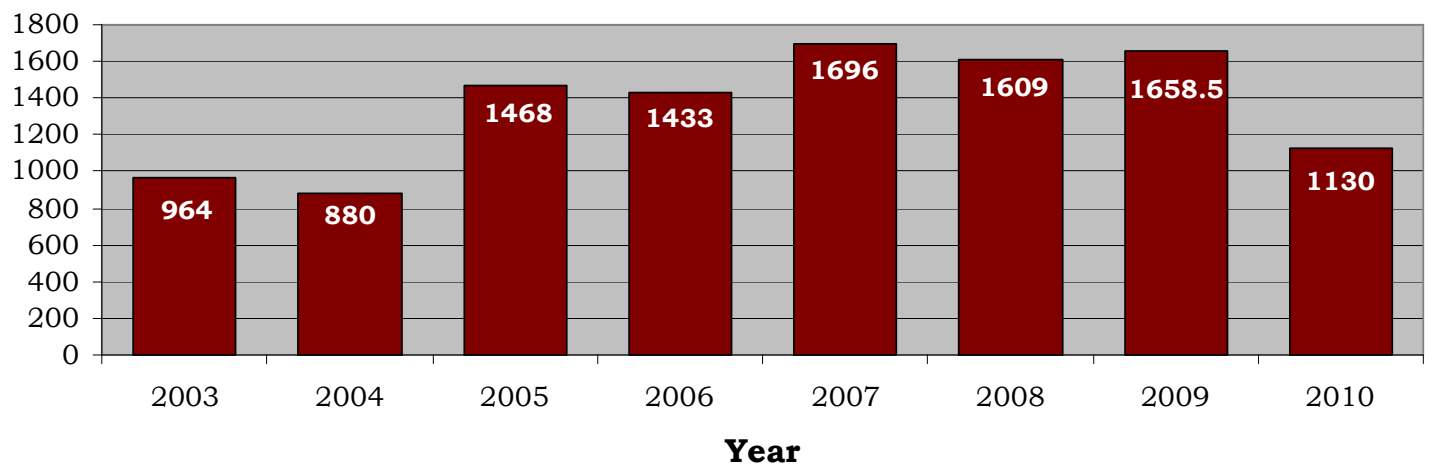


Figure 4: Number of VRAP Stations Monitored 1998-2010

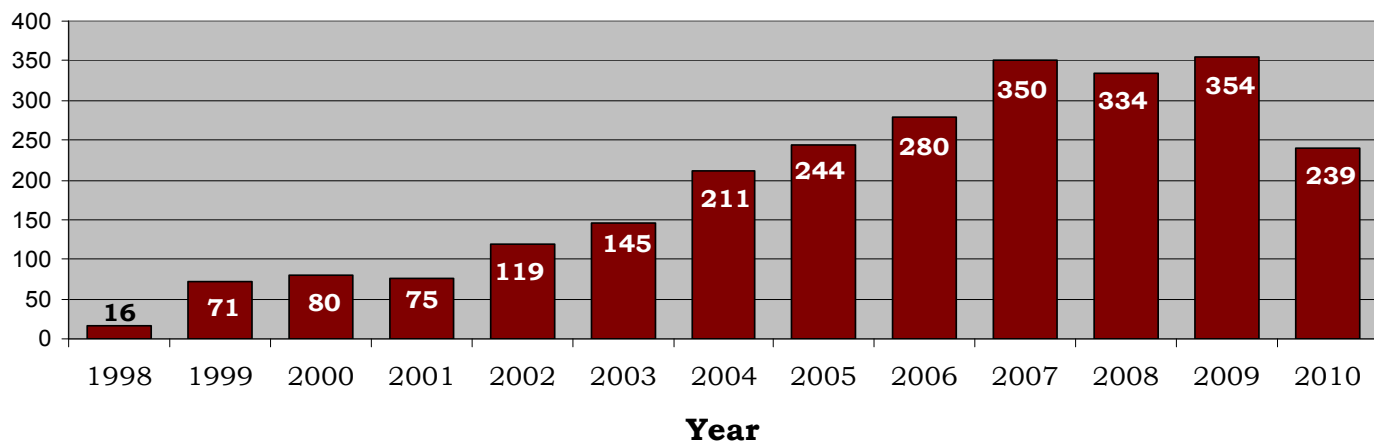


Figure 5: Number of VRAP Field Samples Measured (Excluding Replicates) 1998-2010

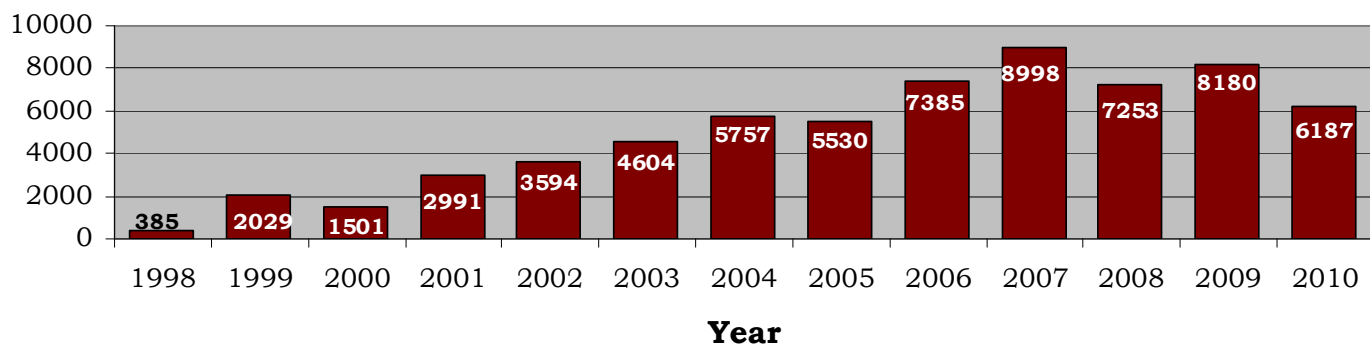
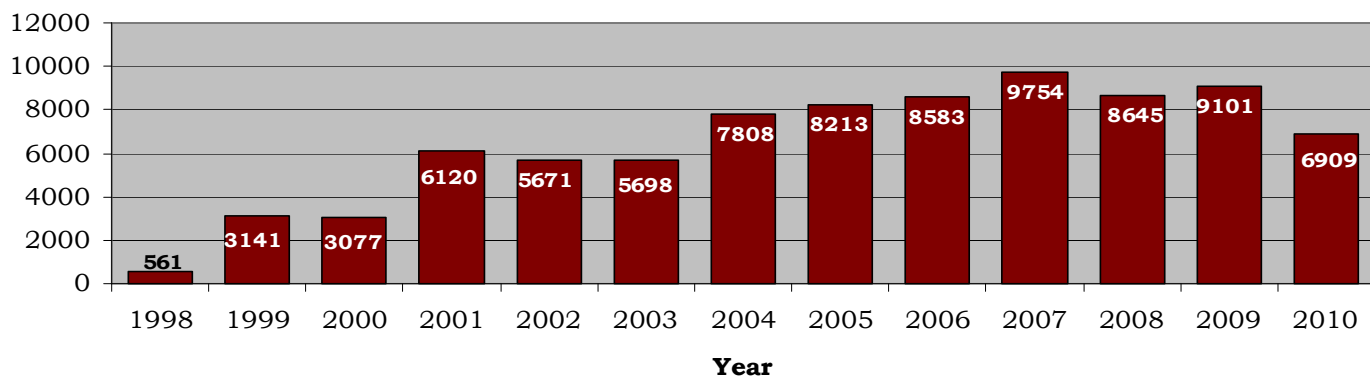


Figure 6: Number of Water Quality Samples Measured (Field Samples + Lab Samples, Excluding Replicates) 1998-2010



Parameter	Parameter Count for Routine Samples Only	Parameter Count Including Replicate Samples
Field Parameters		
■ Dissolved Oxygen (% Sat.)	1,025	1,235
■ Dissolved Oxygen (mg/L)	1,024	1,234
■ pH (std. units)	1,039	1,254
■ Specific Conductance (uS/cm)	1,076	1,288
■ Turbidity (NTU)	988	1,196
■ Water Temperature (C)	1,035	1,246
Total	6,187	7,453
Laboratory Parameters		
■ Chloride (mg/L)	155	166
■ <i>E.coli</i> (#/100mL)	392	428
■ Total Phosphorous (mg/L)	173	183
Total	720	777
TOTALS	6,909	8,230

II. 2010 QA/QC VRAP SUMMARY

The QA/QC procedures incorporated into the VRAP QAPP are designed to generate data that is of sufficient quality to be useable in NHDES's 305(b) 303(d) reports. Field SOPs and protocols are written to translate the QA/QC requirements of the QAPP into terms and explanations useable by volunteer monitors. Frequent QA/QC checks by VRAP staff, field audits, and open communication lines with the VRAP groups are to ensure that proper QA/QC procedures are being followed and that a maximum of data collected is useable for assessment purposes.

Documentation/Data Verification

Upon submission of VRAP field data sheets to NHDES, VRAP staff perform a detailed QA/QC check to determine what status the data should be flagged with in the Environmental Monitoring Database (EMD).

- Data is manually entered into the EMD. Templates already exist in the EMD to ensure the proper scientific methods and parameter specific units are documented.
- Data from the EMD is proofed against the original VRAP field data sheets. Any errors are corrected. If necessary VRAP staff will contact the appropriate volunteer coordinator to verify the data.
- The data is then checked against the QAPP requirements documented in Table 4. Data that is invalidated is flagged as such in the EMD with an explanation of why the data was invalidated. (For example, "RPD of sample/replicate 23% exceeds QAPP requirements of less than 10 percent and would be flagged.") Data that is invalidated are also documented in the annual VRAP reports to each group.

The VRAP Quality Assurance/Quality Control (QA/QC) measures include a six-step approach to ensuring the accuracy of the equipment and consistency in volunteer sampling efforts.

- **Calibration:** Prior to each measurement, the pH and DO meters must be calibrated. Conductivity and turbidity meters are checked against a known standard before the first measurement and after the last one.
- **Replicate Analysis:** A second measurement by each meter is taken from the original sample at one of the stations during the sampling day. If the same sampling schedule is used throughout the monitoring season, the replicate analysis should be conducted at different stations. Replicates should be measured within 15 minutes of the original measurements.
- **6.0 pH Standard:** A reading of the pH 6.0 buffer is recorded at one of the stations during the sampling day. If the same sampling schedule is used throughout the monitoring season, the 6.0 pH standard check should be conducted at different stations.
- **Zero Oxygen Solution:** A reading of a zero oxygen solution is recorded at one of the stations during the sampling day. If the same sampling schedule is used throughout the monitoring season, the zero oxygen standard check should be conducted at different stations.
- **DI (De-Ionized) Turbidity Blank:** A reading of the DI blank is recorded at one of the stations during the sampling day. If the same sampling schedule is used throughout the monitoring season, the blank check should be conducted at different stations.
- **End of the Day Conductivity and Turbidity Meter Check:** At the conclusion of each sampling day, the conductivity and turbidity meters are re-checked against a known standard.

Measurement Performance Criteria

Precision is calculated for field and laboratory measurements through measurement replicates (instrumental variability) and is calculated for each sampling day. The use of VRAP data for assessment purposes is contingent on compliance with a parameter-specific relative percent difference (RPD) as derived from equation 1, below. Any data exceeding the limits of the individual measures are disqualified from surface water quality assessments. All data that exceeds the limits defined by the VRAP QAPP are acknowledged in the data tables. Table 4 shows typical parameters studied under VRAP and the associated quality control procedures.

(Equation 1)

$$RPD = \frac{|x_1 - x_2|}{\frac{x_1 + x_2}{2}} \times 100 \%$$

where x_1 is the original sample and x_2 is the replicate sample

Table 3. Field Analytical Quality Controls

Water Quality Parameter	QC Check	QC Acceptance Limit	Corrective Action	Person Responsible for Corrective Action	Data Quality Indicator
Temperature	Measurement Replicate	RPD < 10% or Absolute Difference <0.8 C.	Repeat Measurement	Volunteer Monitors	Precision
Dissolved Oxygen	Measurement Replicate	RPD < 10%	Recalibrate Instrument Repeat Measurement	Volunteer Monitors	Precision
	Known Buffer (Zero O ₂ Sol.)	RPD < 10% or Absolute Difference <0.4 mg/L	Recalibrate Instrument Repeat Measurement	Volunteer Monitors	Relative Accuracy
pH	Measurement Replicate	Absolute Difference <0.3 pH units	Recalibrate Instrument Repeat Measurement	Volunteer Monitors	Precision
	Known Buffer (pH = 6.0)	± 0.1 std units	Recalibrate Instrument Repeat Measurement	Volunteer Monitors	Accuracy
Specific Conductance	Measurement Replicate	RPD < 10% or Absolute Difference <5µS/cm	Recalibrate Instrument Repeat Measurement	Volunteer Monitors	Precision
	Known Standard	± 20% µS/cm	Recalibrate Instrument Repeat Measurement	Volunteer Monitors	Accuracy
Turbidity	Measurement Replicate	RPD < 10% or Absolute Difference <1.0 NTU	Recalibrate Instrument Repeat Measurement	Volunteer Monitors	Precision
	Method Blank (DI Water)	± 0.1 NTU	Recalibrate Instrument Repeat Measurement	Volunteer Monitors	Accuracy
Laboratory Parameters	Measurement Replicate	RPD < 20% or Absolute Difference less than ½ the mean value of the parameter in NHDES's Environmental Monitoring Database	Repeat Measurement	Volunteer Monitors	Precision

III. SUMMARY OF 2010 QA/QC RESULTS

A. Description of Training Activities

For Volunteers:

- From April through May 2010, VRAP organized six training workshops. Training workshops were held in Meredith, Keene, Concord, Littleton, Portsmouth, and Lee. Ninety three volunteers attended the events. Topics included: calibration and meter checks, quality assurance and quality control, sample collection for field and laboratory analysis, order of field tests, sampling techniques, and instruction on water quality parameters and state standards.
- From July through September 2010, 18 field audits were conducted by VRAP staff. To facilitate this process, the *“Field Sampling Procedures Assessment”* data sheet was revised and used to assess sampling procedures during the field audit.

For the VRAP Intern:

The VRAP intern hired for the 2010 season was new to the program.

- The VRAP intern was trained on proper use of hand-held water quality sampling equipment and in-situ multiparameter dataloggers according to the approved SOPs. This instruction was given both in the “classroom” (NHDES office and laboratories in Concord) as well as in the field.
- The VRAP intern was trained on proper laboratory sampling techniques, collection methods, sample volumes, container sizes/types, as well as preservative requirements and holding times at the NHDES office and laboratories in Concord as well as in the field.
- The VRAP intern also accompanied other NHDES Watershed Management Bureau staff and experienced interns on several field days for additional training. Additional trainings would have occurred if the VRAP intern had not been comfortable with the instrumentation or procedures.

B. Documentation of Usable Data Versus Actual Data Collected

Field Measurements and Grab Sampling

VRAP staff reviewed all results from field sampling and laboratory analysis. Comments relative to the field data were written directly on the field data sheets, whereas comments relative to laboratory data were written directly on the laboratory results sheets. Table 5 summarizes the number of data points collected for each parameter and the corresponding number and percent of invalid data. During 2010, 8,230 instantaneous data points were collected via VRAP. Of these, 306 or 3.72 percent were ruled invalid (Table 5).

Data was classified as invalid if calibrations were not conducted, replicates did not meet the requirements in Table 4, or the program manager had other reasons to question the validity of the data. The invalid data were input to the Environmental Monitoring Database (EMD), but will not be used for surface water quality assessment purposes. Invalid data is specifically flagged in the EMD as such.

Table 4. Summary of Data Verification - 2010

Parameter	Parameter Count for Routine Samples Only	Invalid Count	% Invalid
Field Parameters			
■ Dissolved Oxygen (% Sat.)	1,235	83	6.72
■ Dissolved Oxygen (mg/L)	1,234	103	8.35
■ pH (std. units)	1,254	16	1.28
■ Specific Conductance (uS/cm)	1,288	62	4.81
■ Turbidity (NTU)	1,196	30	2.51
■ Water Temperature (C)	1,246	10	0.80
Total	7,453	304	4.08%
Laboratory Parameters			
■ Chloride (mg/L)	166	00	0.00
■ <i>E.coli</i> (#/100mL)	428	02	0.47
■ Total Phosphorous (mg/L)	183	00	0.00
Total	777	02	0.26%
TOTALS	8,230	306	3.72%

C. Use and Effectiveness of Corrective Actions

Corrective actions were rarely necessary during the sampling season. VRAP staff remained in contact with VRAP group leaders and volunteers throughout the year and immediately communicated any problems with the data or sampling techniques. When questions or problems did arise they were quickly corrected.

D. Conformance to QAPP Requirements/Descriptions of Deviations

Table 5 shows the inconsistencies with the approved VRAP QAPP during the 2010 monitoring season.

Table 5: Non-Conformances with the Approved NHDES VRAP QAPP Identified Following the 2010 VRAP Monitoring Season

QAPP Inconsistency Number	QAPP Section	Description	QAPP/SOP Inconsistency	Reconciliation of QAPP Inconsistency
2010-01	7.2	Measurement Performance Criteria	<u>Precision – Turbidity</u> : If replicate pairs had turbidity values of >10 NTU, an RPD of <10% was used to validate or invalidate data. Similarly, if replicate pairs had turbidity values of ≤ 10 NTU, an absolute difference of 1.0 NTU was used to validate or invalidate data.	The updated VRAP QAPP incorporates this change to the turbidity precision requirement. This change is consistent with the ARMP program. QAQC checked and data validation adjusted to accommodate new precision standard. The new VRAP QAPP is expected to be finalized by the start of the 2011 sampling season.
2010-02	7.2	Measurement Performance Criteria	<u>Precision – <i>E. coli</i></u> : The approved RPD for <i>E. coli</i> bacteria was exceeded on a number of occasions, but the data were flagged as “Valid” in the EMD. This will not reduce the quality of the data.	The updated VRAP QAPP incorporates this change to the <i>E. coli</i> precision requirement. The RPD was changed from 50% and 20% to 100% for all replicate samples. The new VRAP QAPP is expected to be finalized by the start of the 2011 sampling season.
2010-03	7.2	Measurement performance criteria	<u>Relative percent difference (RPD) and absolute difference between replicate samples</u> : Acceptance limits were revised for water temperature, dissolved oxygen, pH, specific conductance, turbidity, nitrate+nitrite, TKN, ammonia, BOD ₅ , hardness, alkalinity, total solids, total suspended solids, <i>E. coli</i> , aluminum, and chlorophyll <i>a</i> .	The updated VRAP QAPP incorporates this change. The new VRAP QAPP is expected to be finalized by the start of the 2011 sampling season.
2010-04	13.1	Sampling Quality Control	<u>Field Duplicates</u> : During the 2010 season VRAP groups were not required to collect duplicate samples as they had in the past. This decision was made due to the inability to determine if any variability between the duplicate and sample was due to instrument issues or true environmental variability.	The updated VRAP QAPP incorporates this change and eliminates the need for collecting duplicates. The new VRAP QAPP is expected to be finalized by the start of the 2011 sampling season.
2010-05	16.1	Technical System Audits	Technical system audits were conducted for 58% of VRAP groups whereas the QAPP requires that all groups be audited. In addition some audits were conducted in conjunction with field visits to groups for other purposes.	Conducting field audits to all VRAP groups was not possible due to budget and staff reductions to the program. Audits were targets and groups most in need of assistance. Field data sheets were inspected by VRAP staff to detect any problems and when needed VRAP staff contacted VRAP groups to seek resolution to any problems identified.